among Vascular Cryptogams is three; this is again a point in common with certain Muscineæ.

This would not be the place to enter upon those details of the mode of development of the embryo, which Dr. Treub has worked out with such signal success It must suffice, while referring those who are specially interested in the subject to the original paper, to state merely the most prominent facts. In the first place there is a considerable difference between the development of the embryo in *L. cernuum*, and that of *L. Phlegmaria*, while in certain points the latter corresponds to *Selaginella Martensii*. Thus the ovum in *L. Phlegmaria* divides first by a wall perpendicular to the axis of the archegonium into two: of these, the cell next the neck becomes the suspensor, the other is the mother-cell of the embryo; the latter develops ultimately into a multicellular mass arranged in two tiers: the lower tier forms only the massive "foot," while from the upper (*i.e.* that further from the neck of the archegonium) are derived the stem and single cotyledon, and ultimately also the first root. The mode of origin of the root is interesting in connection with my own recent observations of the exogenous origin of the root in Phylloglossum. According to Dr. Treub's observations, the first root of *L. Phlegmaria* is at first covered by an envelope a single layer of cells in thickness, which cannot rightly be regarded as the outermost layer of the root-cap; accordingly we have the barest possible example of endogenous formation, only a step removed from the exogenous. These and other results of the investigation of the development of the embryo of *L. Phlegmaria* afford fresh material of the greatest value for comparison, not only with other groups of the Vascular Cryptogams and with the Muscineæ, but also with other species of the genus Lycopodium. Further, the full account given of the prothallus provokes a comparison which Dr. Treub has embodied as follows (p. 88):—"As far as it is possible to judge at present, we find in the sexual generation of the Lycopods, more clearly than elsewhere, transitional terms between the great series of the Muscineæ and that of the Vascular Cryptogams." Some readers will doubtless call to mind, in connection with this, a striking passage by a well-known botanist, Prof. Goebel, written a few years ago (Schenck's *Handbuch der Botanik*, Bd. ii. p. 401), which runs thus:—"We must then satisfy ourselves by asserting that the gulf between the Mosses and Pteridophyta is the deepest that we know in the vegetable kingdom, and bridging it over by hypotheses and explanations does not make it one whit the less."

In this treatise of Dr. Treub we are put in possession of those positive observations which, beyond their intrinsic and independent interest, acquire the highest possible value from the fact that they fit into this wide and deep gulf, and materially help to fill it up. Such observations, and the theoretical considerations which follow them, are sure of a hearty welcome among the fellow-countrymen of Charles Darwin.

I cannot close this article without a brief reference to the peculiar case of symbiosis found in the prothalli of *L. Phlegmaria*. Endophytic Fungi have already been described in prothalli of other species, and here Dr. Treub finds the tissues constantly infested by a fungus, apparently one of the Peronosporeæ. Its thin filaments inhabit the interior of the cells themselves, but without killing them, the nuclei of the cells remaining normal, while the growth of the prothallus does not appear to be visibly hindered by its presence. It would appear that we have here a case of "commensal" symbiosis, in the strictly literal sense; unfortunately it is impossible as yet to follow out the subject thoroughly into its details, but we may hope that Dr. Treub may be able shortly to give us some more general insight into the economic relations of the two organisms thus amicably associated together.

F. O. BOWER

THE UNITED STATES FISHERIES[1]

THESE two volumes, with the familiar black cloth binding, shiny paper, and plates of photo-engravings, characteristic of American official publications, are the first instalment of a series, which is to contain the results of an exhaustive survey of the United States fisheries from all possible points of view. The purpose and method of the survey, and the history of its origin and progress, are sketched in a prefatory note by Mr. Spencer F. Baird. In 1879 it was arranged that the Tenth Census, which is under the direction of General Francis A. Walker, should co-operate with the Commission of Fish and Fisheries in carrying out an historical and statistical investigation of the fishery industries. The direction of the whole survey was intrusted to Mr. G. Brown Goode, Assistant Director of the National Museum, who had for some years previously devoted a large portion of his time and energies to the study of the fisheries. The work to be carried out was divided by Mr. Brown Goode into seven departments:—(1) Natural history of aquatic products; (2) the fishing grounds; (3) the fishermen and fishing towns; (4) apparatus and methods of capture; (5) products of fisheries; (6) preparation and manufacture of fishery products; (7) economy of the fisheries. The co-operation of every person who had any special knowledge of the subjects under consideration was secured. The field-work was so divided that each portion could be assigned to men who were most competent from their previous experience to undertake it. The shad and alewife fisheries, for example, were assigned to Colonel Marshall MacDonald, the Alaska fisheries to Dr. T. H. Bean.

It was understood from the beginning that the results obtained should be set forth in a series of finished reports, of which those referring principally to the exploited organisms, namely, fish and aquatic animals, should be presented to and published by the Fish Commission, while those dealing with the exploiting organisms, the fishermen and manufacturers, should be the property of the Census Office. The expenses of the work have been shared between the Commission and the Census. The reports prepared for the Fish Commission being too bulky for publication in the annual reports, permission was obtained from the Senate and House of Representatives to publish them separately. The series will be as follows:—Section i. natural history of useful aquatic animals (the two volumes now before us); ii. the fishing grounds; iii. the fishing towns; iv. the fishermen; v. the apparatus of the fisheries and the fishing vessels and boats; vi. the fishery industries; vii. the preparation of fishery products; viii. fish culture and fishery legislation; ix. statistics of production, exportation, and importation; x. the whale fishery; xi. a catalogue of the useful and injurious aquatic animals and plants of North America: xii. a list of books and papers relating to the fisheries of the United States; xiiii. a general review of the fisheries, with a statistical summary.

The statistical reports prepared for the Census Office are ten in number. The results they contain have been already partially published in Census bulletins and in statistical tables scattered here and there in various volumes. The prefatory note concludes with a brief summary of the statistics of the fisheries. In 1880 the number of persons employed in fishery industries was 132,426, of whom 101,684 were fishermen. The total value of the capital invested was $37,955,349.

After the prefatory note we find the letter of transmittal from Mr. Brown Goode to Prof. Baird. In this it is stated that the work is intended especially for the use of the reading public, and technical zoological discussions

[1] "The Natural History of Useful Aquatic Animals of the United States," forming Section i. of "Fisheries and Fishery Industries of the United States." 1 vol. Text; 1 vol Plates. 4to. (Washington, Government Printing Office. 1884.)

and descriptions have not therefore been included. On another fly-leaf is a list of the authors who have had a share in the production of the work. The number of these is no less than twenty, and among them are such familiar names as Tarleton H. Bean, John A. Ryder, and R. Edward Earll.

The work is divided into five parts: i. mammals; ii. reptiles and batrachians; iii. fishes; iv. mollusks; v. crustaceans, worms, radiates, and sponges. Of the mammals the whales and porpoises are described by G. Brown Goode; seals and walruses, by Joel A. Allen, and Henry W. Elliott, who contributes a chapter on the life-history of the fur-seal; manatees and the Arctic sea-cow, by Frederic W. True. The reptiles and batrachians are also treated by Mr. True. Mr. Brown Goode is responsible for the greater part of the portion dealing with the fishes. The part on mollusks consists of two chapters, one on mollusks in general, by Ernest Ingersoll; one on the oyster, by John A. Ryder. Part V. is the work of Richard Rathbun.

The work of Mr. Brown Goode is always lucid, systematic, and complete. In his account of the whales and porpoises he does not give technical zoological diagnoses, these being, as we have already mentioned, intentionally omitted throughout the work, but he gives the accepted name with its authorities accurately indicated. He describes fully, with references to all the literature of the subject, the distribution, habits, food, and reproduction of all the species having an economic value. Figures of nearly all the species are given; these are taken from various sources, some prepared specially for the present work, some copied from the plates of existing zoological memoirs.

A discrepancy occurs between the title of one of the figures and the description contained in the text: the porpoise sperm whale is stated to have been described by Prof. Gill, under the name *Kogia Floweri*, while the figure given is entitled *Kogia Goodei*, True, the pygmy sperm whale. Two sketches illustrating the whale fishery are reproduced in Plates 3 and 10. The account of the "right whales" is not altogether clear. It takes some time to find out that the species generally known as the "right whale" is *Balæna mysticetus*, L., which is the Arctic whale, or bowhead; while the true right whale is Eubalæna, Cope: but the assertion that *Eubalæna cisarctica*, Cope, is not remotely related to *Eubalæna biscayensis* of the Eastern Atlantic, remains a puzzle.

Mr. Allen's work on the seals is thoroughly satisfactory, and the history of the fur-seal at the Pribylov Islands, given by Mr. Elliott, contains the results of accurate personal observation, which has at last elucidated the meaning of the peculiar and long-known habits of this species. The movements of *Callorhinus ursinus* when absent from its breeding places remain for the present obscure, but the reason why it seeks its breeding places so regularly, and the facts of its reproduction—knowledge of which is necessary in order that a permanent diminution of the numbers of the animal may be avoided—are clearly set forth in this essay.

The illustrations of the account of the seals and of Mr. Elliott's essay are particularly good. Among the former are two maps of the world, showing at a glance the geographical distribution of the useful seals. Mr. Elliott's original sketches of the fur-seal at home in the Pribylov Islands are very spirited and interesting.

Mr. True gives an account of the South American manatee, and reviews lucidly the history of the extinct Rhytina of Behring's Strait.

The chapter on the reptiles and amphibians is entirely unillustrated, for what reason does not appear. The reptiles which afford products useful to man are the alligator, the turtles and tortoises, and one frog—*Rana catesbiana*, Shaw—the bull-frog. This last animal is cultivated in several localities, the eating of the hind-legs being common in most towns of the States.

The note at the commencement of Part III. on the food-fishes is a little inconsistent. "We anticipate the criticism that the book is of no use in identifying the different kinds of fish, by the statement that we expressly desire that it shall not be," is one sentence; and another is, "Most of our important species can be identified by reference to the plates." What the writer evidently means to say is that each species mentioned is accurately figured and receives its correct technical name, so that any one interested in fishes can find out the zoological name of his specimens from the plates, and can read all about range and economical uses, while for more detailed scientific treatment reference must be made to speciegraphical works in ichthyology. Various ichthyologists have contributed to this portion of the work. The fishes of the Pacific coast are the special province of David S. Jordan, while one or two species, like the Californian salmon and the carp, have been allotted to pisciculturists specially familiar with them. Many vexed questions in the biology of fishes are discussed by Mr. Brown Goode with his usual lucidity and comprehensiveness. The pages on the reproduction of the eel, for example, are very interesting reading, and this is by no means a solitary example. The food-fishes naturally take up a large portion of the whole work. They occupy more than half of the volume of text, extending to more than 500 pages. In the plates there is one feature which we have after serious efforts completely failed to understand. On nearly every plate there is a straight line below each figure, apparently intended as some standard of measurement; but the meaning of these lines is not explained.

In his chapter on the mollusks Mr. Ingersoll has not always observed the rule strictly followed in the rest of the work of giving the authority for each specific name used. He gives an account of the distribution of the numerous other species of Lamellibranchs used as food in the United States, but gives no description of oyster-beds. In Mr. Ryder's account of the life-history of the oyster there is a great deal of interesting detail about anatomy and development, and about the writer's own experiments in oyster-culture, but a general account of the distribution of *Ostrea virginica* is wanting. This is a surprising omission, and one much to be regretted.

Why Mr. Rathbun, even in a work intended for general readers, should unite together Echinoderms and Cœlenterates as Radiates is a question which it would be difficult to answer. The name Radiata would require to be considered in a history of zoology, but it is impossible to justify its use in the classification of animals for any purpose in the present state of science. But this and the other slight defects we have pointed out do not make a very great reduction in the value and completeness of the whole work. The labour spent in its preparation has been very great, and the result is a lasting monument to the industry and scientific capacity of Mr. Browne Goode and his numerous fellow workers.

REMARKS ON THE EGGS OF BRITISH MARINE FISHES[1]

THE majority of marine fishes, in regard to reproduction, readily range themselves into certain groups according to the condition of the eggs on deposition. Thus (*a*) a considerable number have delicate pelagic ova, which are generally separate, though in the frog-fish, for instance, they form gelatinous masses. (*b*) Others are characterised by the deposition of thick-walled ova, connected together in more or less firm masses, on or near the bottom, or in special nests. (*c*) A third group is distinguished by laying ova which have filamentous processes or adhesive surfaces for attachment to foreign structures; and some place them in brood-pouches of the males, in which case, however, the capsules appear to be

[1] By Prof. McIntosh, F.R.S., &c., St. Andrews Marine Laboratory.